AUTO-CLOSABLE FLEXIBLE DISPLAY DEVICE

FIELD OF THE INVENTION

This invention relates generally to flexible display devices, and more specifically to flexible display devices providing an auto-closable flexible display.

BACKGROUND

Miniaturization and increased processing power has recently allowed great increases in the portability of electronics. Complex devices have been reduced to pocket size. Wherever they desire, consumers are able to carry and use such devices as cellular telephones, music players, game players, still and motion digital cameras, and GPS locators. Still, the size and form factor of the devices is often limited by the optical display because most devices currently use an inflexible glass optical display. Such displays are bulky, heavy, expensive, and fragile. Fragility increases with increasing display size, but limiting display size reduces the usefulness of the device. Content requiring high resolution, such as maps, cannot be shown on a small display.

To obtain greater portability and avoid the drawbacks of glass optical displays, flexible displays have been developed. Flexible displays are typically made of a flexible material that can be rolled about a cylinder or folded in a housing for storage in a closed position when not in use. To use the flexible display, the user pulls an exposed end of the flexible display with one hand while grasping the housing with the other hand. The flexible display switches to an open position to display the content desired. The flexible display devices often use a lightweight spreader mechanism to maintain the flexible display in the open position.

Although the flexible display and the spreader mechanism are enclosed within a housing and well protected when the flexible display device is in the closed position, the flexible display device is vulnerable to damage when in the open position. The flexible display can be torn or punctured and the spreader mechanism bent or twisted if the flexible display device is dropped to the floor while open. There have been attempts to make flexible display devices more rugged by adding shock absorbing materials and heavier components, but this makes the flexible display devices heavier and less portable.

SUMMARY OF THE INVENTION

It would be desirable to have a flexible display device that overcomes the above disadvantages.

One aspect of the present invention provides a flexible display device including a flexible display; a spreader mechanism operably connected to the flexible display, the spreader mechanism having a latch assembly to maintain the spreader mechanism in an open position; an acceleration sensor generating an acceleration signal; and an acceleration processor responsive to the acceleration signal and generating a close signal when the acceleration signal exceeds a predetermined acceleration limit. The latch assembly is responsive to the close signal to release the spreader mechanism from the open position.

Another aspect of the present invention provides a method for auto-closing a flexible display device having an open position and a closed position including measuring acceleration of the flexible display device; determining whether the acceleration exceeds a predetermined minimum acceleration limit; and releasing the flexible display device from the open position when the acceleration exceeds the predetermined minimum acceleration limit.

Another aspect of the present invention provides a flexible display device system including a flexible display device having means for spreading a flexible display, the spreading means having an open position and a closed position; means for measuring acceleration of the flexible display device; means for determining whether the acceleration exceeds a predetermined minimum acceleration limit; and means for releasing the spreading means from the open position when the acceleration exceeds the predetermined minimum acceleration limit.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features and advantages of the invention will become further apparent from the following detailed description of the presently preferred embodiment, read in conjunction with the accompanying drawings. The detailed description and drawings are merely illustrative of the invention rather than limiting, the scope of the invention being defined by the appended claims and equivalents thereof.

FIG. **1** is a front view in the extended configuration of a flexible display device made in accordance with the present invention;

FIG. **2** is a detail view of a latch assembly for the flexible display device of FIG. **1** made in accordance with the present invention;

FIG. **3** is a front view in the extended configuration of another flexible display device made in accordance with the present invention;

FIG. **4** is a detail view of a latch assembly for the flexible display device of FIG. **3** made in accordance with the present invention;

FIG. **5** is a block diagram of a control circuit for a flexible display device made in accordance with the present invention; and

FIG. **6** is a flow chart of a control method for a flexible display device made in accordance with the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front view in the extended configuration of a flexible display device made in accordance with the present invention. In this example, the flexible display device uses a coil in the latch assembly to magnetically release the spreader mechanism from the open position when the flexible display device is dropped.

The flexible display device **30** includes a first frame **32**, a second frame **34**, a flexible display **38**, and a spreader mechanism **50**. The spreader mechanism **50** is operably connected to the flexible display **38** through the first frame **32** and second frame **34** to maintain the flexible display **38** in a planar configuration when the flexible display device **30** is in the open position as illustrated. The spreader mechanism **50** has a latch assembly **36** that maintains the spreader mechanism **50** in an open position. An acceleration sensor generates an acceleration signal for the flexible display device **30**, such as an acceleration signal for the center of mass of the flexible display device **30**. An acceleration processor responsive to the acceleration signal generates a close signal when the acceleration signal exceeds a minimum acceleration limit, such as a fraction of the gravitational acceleration of g or 9.8 m/sec^2. The latch assembly **36** is responsive to the close signal to release the spreader mechanism **50** from the open position. In